DOCUMENT RESUME

ED 109 213 TM 004 671

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TITLE GATB: Does the Apparatus Make a Difference?
PUB DATE 24 Mar 75
NOTE 14p.; Paper presented at the Annual Meeting of the American Personnel and Guidance Association (New York, New York, March 24, 1975)

EDRS PRICE MF-$0.76 HC-$1.58 PLUS POSTAGE
DESCRIPTORS *Aptitude Tests; *Comparative Statistics; Elementary Secondary Education; Scores; *Testing; *Testing Problems; Test Reliability; Test Validity
IDENTIFIERS *General Aptitude Test Battery; Testing Apparatus

ABSTRACT

Two independent studies were conducted to investigate possible differences in General Aptitude Test Battery (GATB) aptitude M resulting from the use of different test equipment (wooden vs. plastic apparatus.) As part of a ten-year longitudinal study of Vocational Development being conducted in the Department of Vocational Education at The Pennsylvania State University, it was decided to administer the GATB to an entire ninth grade class. Because both wooden and plastic pegboards were being used to assess GATB aptitude M, it was decided to compare the scores obtained on the two different types of boards. Results indicate that those students who were tested using the wooden boards performed significantly better than did the students tested on the plastic boards. Converted score differences for aptitude M range from 3 to 26 points with an average difference of 11 points. Stimulated by the initial finding of an average difference of 11 points in aptitude M resulting from the use of plastic vs. wooden pegboards with ninth graders, Trimmer and Klein (1974) replicated the above described study using a sample of 238 adult applicants, including 70 Blacks, as part of routine employment testing in Nevada. In this study, an average difference of 10.5 points was observed. These findings raise serious moral, ethical and legal questions, and therefore it appears to be necessary to either establish norms for the plastic equipment or to discontinue its use. (Author/BJG)

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GATB: Does the Apparatus Make a Difference?

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New York City

March 24, 1975

TM 004 671

ABSTRACT

GATB: Does the Apparatus Make a Difference

This presentation reports and discusses the results of two independent studies conducted to investigate possible differences in GATB aptitude M resulting from the use of different test equipment (wooden vs. plastic apparatus).

As part of a ten year longitudinal study of Vocational Development being conducted in the Department of Vocational Education at The Pennsylvania State University, it was decided to administer the GATB to an entire ninth grade class of 1050 boys and girls. Because both wooden and plastic pegboards were being used to assess GATB aptitude M, it was decided to compare the scores obtained on the two different types of boards. Results of the study indicate that those students who were tested using the wooden boards performed significantly better than did the students tested on the plastic boards. Converted score differences for aptitude M ranged from 3 to 26 points with an average difference of 11 points.

Stimulated by the initial finding of an average difference of 11 points in aptitude M resulting from the use of plastic vs. wooden pegboards with ninth graders, Trimmer and Klein (1974) replicated the above described study using a sample of 238 adult applicants, including 70 Blacks, as part of routine employment testing in Nevada. In this study, an average difference of 10.5 points was observed.

These findings raise serious moral, ethical and legal questions, and therefore it appears to be necessary to either establish norms for the plastic equipment or to discontinue its use.

Introduction

During the spring of 1969, the Department of Vocational Education at The Pennsylvania State University undertook the beginning of a ten year longitudinal Vocational Development Study (VDS) (Impellitteri and Kapes, 1971). Since the General Aptitude Test Battery (GATB) had been released for use at the ninth grade level, it was decided to use the GATB as the aptitude measure for the project. A factor which influenced the selection of the GATB was the availability of manipulation aptitudes (K, F and M) as well as cognitive aptitudes as part of the nine aptitudes included in the GATB.

In order to become certified to administer the GATB, the VDS project staff received several days of training which was provided by personnel from the Pennsylvania State Employment Service. Equipment for the test was purchased and while five wooden pegboards were available from a previous project, five new plastic boards were purchased at that time. The pegboards are required for parts 9 and 10 which are combined to form aptitude M (Manual Dexterity). The manual for the GATB, Section III: Development, October (1967) describes the pegboard as a "rectangular wooden board divided into two sections containing 48 holes." While the new plastic boards were obviously intended to provide the same measurement task as the old wooden boards, the question arose in the minds of the project staff that perhaps the boards would produce different scores. In order to provide an answer to this question, the VDS project staff decided to collect data separately on each of the two types of pegboards and make a comparison at the end of the testing.

The results of this comparison indicated that students tested with the wooden apparatus performed significantly better than students tested with the plastic apparatus. Converted score differences for aptitude M

ranged from 3 to 26 points with an average difference of 11 points. The results of this study were published in the June, 1973 issue of the Journal of Employment Counseling (Kapes and Sievert, 1973).

Stimulated by the finding of this study, Trimmer and Klein (1974) designed a replication study which included a broader sample. The results of this replication study yielded an average difference of 10.5 points on aptitude M in favor of the wooden apparatus.

This paper deals with the two studies described above. A review of previous research is provided along with a comparison of each study in terms of sample, procedures, and results. Since a replication of this nature is very rigorous in terms of guarding against Type I errors (chance differences), fairly concrete conclusions which follow from the two studies are presented and discussed.

Review of Previous Research

The following table has been adapted from the Trimmer and Klein (1974) study. It provides a good summary of the findings of previous research on the topic. All of the studies reported in the table were obtained through the North Carolina Employment Security Commission (1970) technical report.

While the literature is not consistent, it appears that when wooden boards and pegs are compared to plastic boards and pegs, the wooden boards yield higher scores especially on part 9. Mixing of boards and pegs does not appear to result in differences greater than those which would occur by chance, although it appears that wooden pegs yield higher scores than plastic pegs in either type of board.

TABLE I

PREVIOUS RESEARCH *

DATE	INVESTIGATOR	SAMPLE SIZE	POPULATION	APPARATUS	RESULTS
1966	Ohio Employment Service	98	Office Staff	W & P Boards One type peg	No Differences
1967	New Jersey Employment Service	180	Office Counselors	W & P Boards W & P Pegs	No Differences
1968	Louisiana Employment Service	110	Applicants	Plastic Boards	Wood Higher-Pt. 9 No Differences-Pt. 10
1969	Ohio Employment Service	200	Applicants	W & P Boards W & P Pegs	Wood Higher-Pt. 9 No Differences-Pt. 10
1969	New York Employment Service	339	Applicants	W & P Boards W & P Pegs	Wood Higher-Pt. 9 No Differences-Pt. 10
1970	N. Carolina Employment Security	540	Senior H.S. Students	Wood Boards W & P Pegs Plastic Bds. W & P Pegs	Wood Higher-Pt. 9 Not Statistically Significant

* Adapted from the Trimmer and Klein report (1974).

Samples

Kapes and Seivert Study

One thousand-fifty (1050) male and female ninth grade second semester junior high school students volunteered as subjects for this study. The subjects were enrolled in three junior high schools located in Altoona, Pennsylvania. The examinees numbered 515 females and 535 males, with 243 males being tested on the wooden boards and 292 males examined on the plastic boards. The females numbered 231 examined on the wooden boards and 284 on the plastic boards.

Trimmer and Klein Study

This sample consisted of 238 applicants, including 70 blacks and divided between 106 males and 132 females. All subjects were routinely tested in the Las Vegas local office of the Nevada Employment Service during regularly scheduled testing sessions in November and December of 1973. The subjects were also divided equally on the wooden and plastic boards by age according to the following categories: 18-21 years, N = 80; 22-39 years, N = 130; 40 + years, N = 28.

Procedure

Kapes and Seivert Study

The testing sessions were conducted one day per week for thirteen weeks during ten half hour blocks of time. Subjects were tested in groups of nine and assigned at random to each block of time and to each of the two types of pegboards. All of the parts 9 and 10 were administered by the same examiner, and a separate tally was kept on males and females for

each of the thirteen sessions. The tests were administered with strict adherence to the procedure outlined in the manual for the GATB, Section I: Administration and Scoring, January (1968). A pooled variance t-test was used to examine the differences between mean scores on the wooden vs. plastic pegboards. Homogeneity of variance was tested and variances were found to be equal.

Trimmer and Klein Study

Applicants were tested in groups of ten and were randomly assigned to each of the two types of pegboards. The entire GATB was administered by the test administrator with strict adherence to the GATB manual Section I. Although the Trimmer and Klein study report does not indicate the statistics used, it is assumed that a pooled variance t-test was applied to the data.

Results

Kapes and Seivert Study

An examination of the means for all thirteen sessions taken together indicates an overall mean difference of 5 points for part 9 and 2.6 points for part 10, both significant at the .001 level. Figures 1 and 2 contain the total means and graphically describe the differences for each of the thirteen sessions for males and females separately on parts 9 and 10. Of the total of 26 comparisons for Part 9, 22 produced differences of three points or more. The differences for part 10 were much less dramatic and in five instances the plastic board scores actually exceeded the wooden board scores. When the raw scores for parts 9 and 10 were added together and converted to the Manual Dexterity (M) score the differences between wooden and plastic apparatus ranged from 3 to 26 points with an average difference of 11 points. The same average difference of 11 points was obtained for males and females.

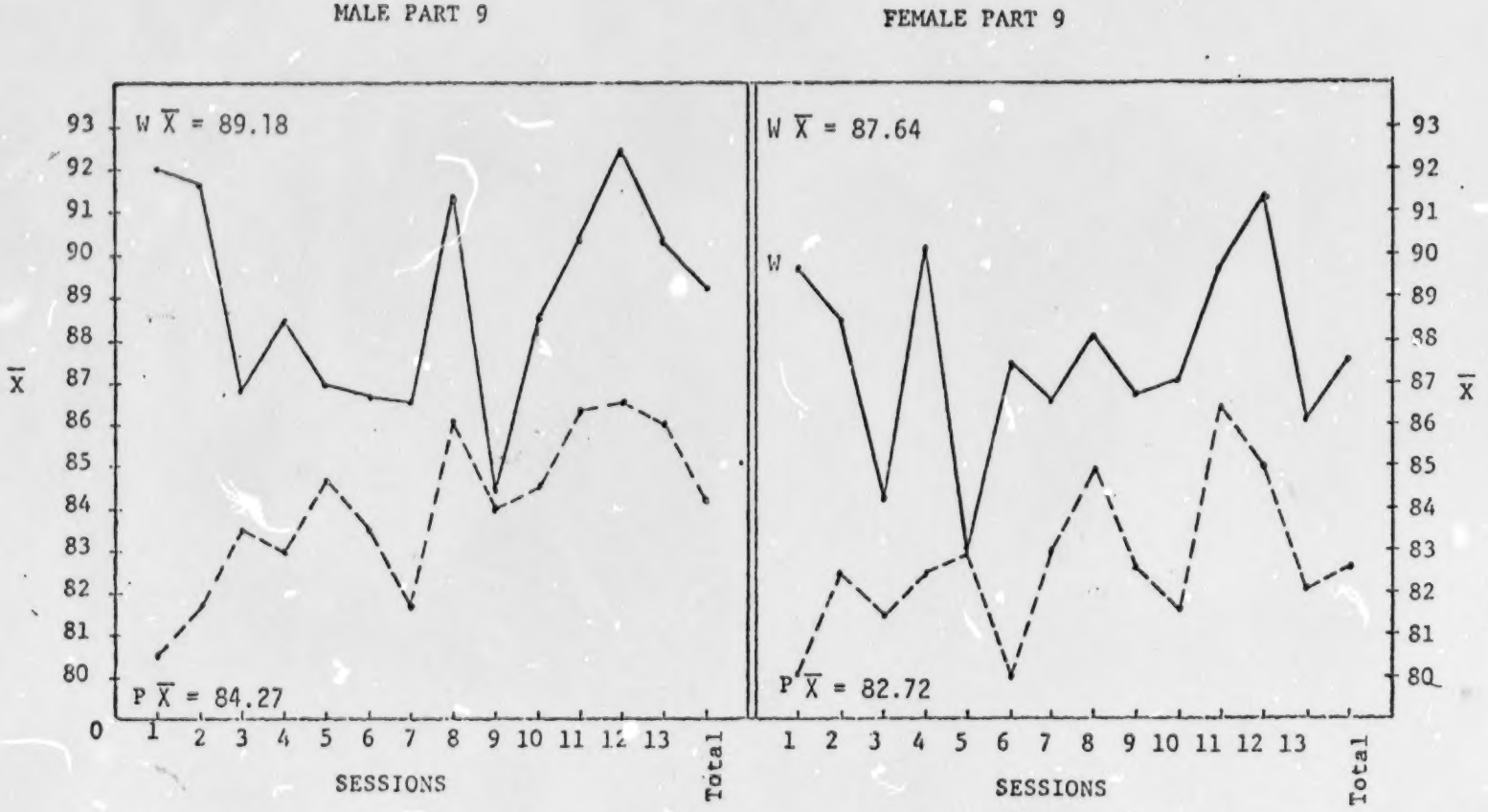

FIGURE 1. GATB PART 9 MEAN SCORES OBTAINED BY BOYS AND GIRLS ON WOODEN AND PLASTIC PEGBOARDS FOR EACH OF 13 SESSIONS AND TOTAL

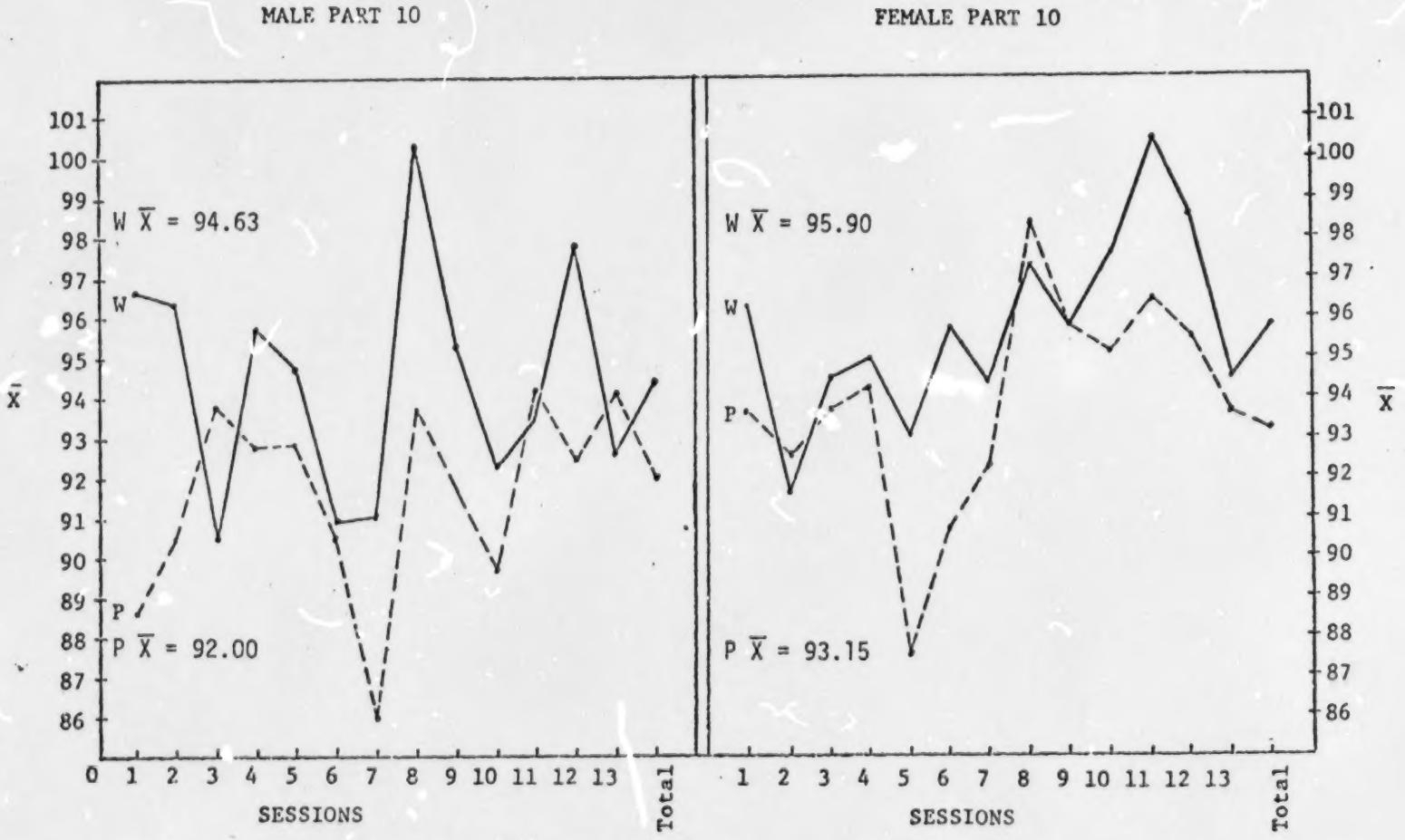

FIGURE 2. GATB PART 10 MEAN SCORES OBTAINED BY BOYS AND GIRLS ON WOODEN AND PLASTIC PEGBOARDS FOR EACH OF 13 SESSIONS AND TOTAL

Trimmer and Klein Study

The results of this study were computed separately by age, sex, and ethnic sub-group and are reported in Table II which has been adapted from the Trimmer and Klein (1974) report. An examination of the means for the total group indicated an overall mean difference of 10.5 points which is significant at the .001 level. (It is not known as to whether the test was one tailed or two tailed). Some differences among the sub-groups can be noted from the table.

Discussion

Considering all of the evidence available from previous research and from the two studies reported here, a rather strong case can be made for the differences between the two types of testing apparatus. Since each of the two studies reported here found almost identical differences with a wide range of samples and since these differences are highly statistically significant (.001) it is extremely unlikely that the differences are chance occurences. More importantly, however, the actual converted M score differences observed are so large (approximately one standard error of measurement) that the practical difference between the two types of equipment is evident in different decisions being made about an individual's ability to qualify for a specific job. The impact of this finding is clearly described in the following quote from the Trimmer and Klein (1974) report:

> This research appears to clearly indicate that the measurement of an individual's manual dexterity on the GATB or a SATB is systematically related to whether he or she was tested using a wooden or plastic pegboard. Since the overall difference approximates one standard error of measurement of the M factor, it is clear that many individuals who might have had a sufficient

TABLE II

Mean Differences of Ethnic Sub Groups by Age and Sex*

Age / Ethnic	MALE Sample	MALE $\bar{M}$ Diff.	FEMALE Sample	FEMALE $\bar{M}$ Diff.	TOTALS (By Age) Sample	TOTALS (By Age) $\bar{M}$ Diff.
18-21 TOTAL	30	15.8	50	7.4	80	10.6
Black	10	8.8	22	13.1	32	11.8
Caucasian	20	19.2	28	2.9	48	9.7
22-39 TOTAL	64	19.5	66	3.5	130	11.3
Black	16	17.5	22	2.8	38	9.0
Caucasian	48	20.1	44	3.7	92	12.3
40 + TOTAL	12	10.5	16	3.6	28	6.6
Black	No Sample		No Sample		No Sample	
Caucasian	12	10.5	16	3.6	28	6.6
(By Sex) TOTALS	106	17.4	132	5.0	238	10.5
Black	26	14.2	44	8.0	70	10.2
Caucasian	80	18.4	88	3.5	168	10.5

NOTE: $\bar{M}$ Differences are all in favor of the wooden equipment.

* Adapted from the Trimmer and Klein report (1974).

> amount of manual dexterity to be considered for a particular job, training opportunity, or apprenticeship program might not have received such an opportunity because they were tested on differing equipment than that on which the original norms were established (p. 4).

In addition to the importance of this finding for employment counselors, school guidance counselors need to be aware of the equipment differences since a number of VDS studies (Kapes, 1971, McAlister, 1973) have shown the GATB - M score to be related to important in-school student characteristics and outcomes.

Conclusions

Because of the overwhelming evidence available as to the differences between the two types of equipment it appears necessary to treat the results of testing on the two different boards as if they have come from two different tests. This implies that either a separate set of norms are necessary or if new norms for the plastic boards are not available, only the old equipment can be used. In summary, the new plastic equipment constitutes a new test which, as in the case of any test, cannot be used until norms are available. Applying the old norms to the new equipment appears to be unwise, unethical and probably illegal.

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